REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
18-08-2010	Final Report	17 August 2009 - 17-Aug-10

4. TITLE AND SUBTITLE

Request for Extension of Grant FA8655-06-1-3017-P00001 Registration of a Dynamic Multimodal Target Image Test Set for the Evaluation of Image Fusion Techniques

5a. CONTRACT NUMBER
FA8655-09-1-3095

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

5d. TASK NUMBER

5e. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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8. PERFORMING ORGANIZATION REPORT NUMBER

N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

EOARD
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10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
Grant 09-3095

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

TNO has completed the construction of the TRICLOBS 3-band nightvision system. This newly developed system consists of two digital image intensifiers (Photonis ICUs) and an uncooled longwave infrared microbolometer (XenICS Gobi 384). This night vision sensor suite registers the visual (400-700 nm), the near-infrared (700-1000 nm) and the longwave infrared bands of the electromagnetic spectrum. The optical axes of the three cameras are aligned, using two dichroic beam splitters (an ITO filter to reflect the LWIR part of the incoming radiation into the thermal camera, and a B43-958 hot mirror to split the transmitted radiation into a visual and NIR part). The field-of-view of the cameras is nearly the same, and any rotations between camera images has been be minimized. The registration of the individual images therefore requires only a minimal amount of computational effort.Software has been developed to register the signals from all 3 cameras simultaneously, display the images, and write them to a hard disk. The system was tested and multiband video was registered during a preliminary pilot field trial in a Dutch MOUT village. The imagery was used to make final adjustments to the camera system before registering imagery in the last phase of this project. The raw imagery has now been registered and fused into a false-color representation, suitable for input to sensor fusion algorithms.

15. SUBJECT TERMS
EOARD, Human Factors, sensors

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18, NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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DEPARTMENT OF THE AIR FORCE
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

August 18, 2010

MEMORANDUM FOR AFRL/HEH (Wright Site Institutional Review Board)

FROM: TNO Defense, Security and Safety, location Soesterberg

SUBJECT: Final report for Grant FA8655-09-1-3095 "Request for Extension of Grant FA8655-06-1-3017-P00001 Registration of a Dynamic Multimodal Target Image Test Set for the Evaluation of Image Fusion Techniques"

1. Status of Study:

TNO has completed the construction of the TRICLOBS 3-band nightvision system. This newly developed system consists of two digital image intensifiers (Photonis ICU's) and an uncooled longwave infrared microbolometer (XenICS Gobi 384). This night vision sensor suite registers the visual (400-700 nm), the near-infrared (700-1000 nm) and the longwave infrared (8-14 μm) bands of the electromagnetic spectrum. The optical axes of the three cameras are aligned, using two dichroic beam splitters (an ITO filter to reflect the LWIR part of the incoming radiation into the thermal camera, and a B43-958 hot mirror to split the transmitted radiation into a visual and NIR part). The field-of-view of the cameras is nearly the same, and any rotations between camera images has been be minimized. The registration of the individual images therefore requires only a minimal amount of computational effort.

Software has been developed to register the signals from all 3 cameras simultaneously, display the images, and write them to a hard disk.

The system was tested and multiband video was registered during a preliminary pilot field trial in a Dutch MOUT village. The imagery was used to make final adjustments to the camera system before registering imagery in the last phase of this project.

Scenarios were designed to record dynamic multispectral imagery during a field trial in the Netherlands in June 2010 . The scenarios included targets with a range of different sizes, thermal and visual contrasts. A multimodal test target, especially designed for this purpose, and kindly provided to TNO by Dr. Alan Pinkus (WPAFB, Dayton, Ohio) was also included in the images. The resulting set of multimodal images can be used for the evaluation of objective image quality metrics.

The imagery was collected at a Dutch military base in Amersfoort (The Netherlands), according to the newly developed scenarios. The scenarios involved the TRICLOBS camera system approaching the targets, which were placed against a \rural background (rugged countryside with heather and trees), which provided a significant level of clutter.

The position of the camera system relative to the location of the targets was accurately registered.

The raw imagery was handed over to Dr. Alan Pinkus (WPAFB, Dayton, Ohio) .

The raw imagery has now been registered and fused into a false-color representation, suitable for input to sensor fusio algorithms. This data will be handed over to Dr. Alan Pinkus during a WoS visit of two TNO employees to WPAFB in September 2010.

2. Summary of Subjects: This study did not involve any experiments with human subjects.

3. Summary of Resources: From the start of the project until August 1, 2010, 185 man-hours have been made, and Euro 969 has been spent on expendable supplies and materials.

4. Objective: The objective of this project was to acquire and register a multimodal target image test set that can be used to assess the operational effectiveness of image fusion techniques for a range of relevant military tasks. This goal has been fully achieved.

5. Publications or Presentations:

1. Toet, A. & Hogervorst, M.A. (2010). Real-time full color real-time multiband night vision. Vision Sensors and Edge Detection. www.sciyo.com: Sciyo. In press.
2. Dijk, D., Schutte, K., Toet, A. & Hogervorst, M.A. (2010). Image enhancement on the INVIS integrated night vision surveillance and observation system. In J.J. Güell & K.L. Bernier (Eds.), *Enhanced and Synthetic Vision 2010*, SPIE-7689-8 (pp. 1-12). Bellingham, WA: SPIE - The International Society for Optical Engineering.
3. Toet, A., Hogervorst, M.A., Dijk, J. & van Son, R. (2010). INVIS: integrated night vision surveillance and observation system. In J.J. Güell & K.L. Bernier (Eds.), *Enhanced and Synthetic Vision 2010*, SPIE-7689-5 (pp. 1-16). Bellingham, WA: SPIE - The International Society for Optical Engineering.

6. Adverse events: No adverse events occurred in this period.

7. Amendments to Protocol: N.A.

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